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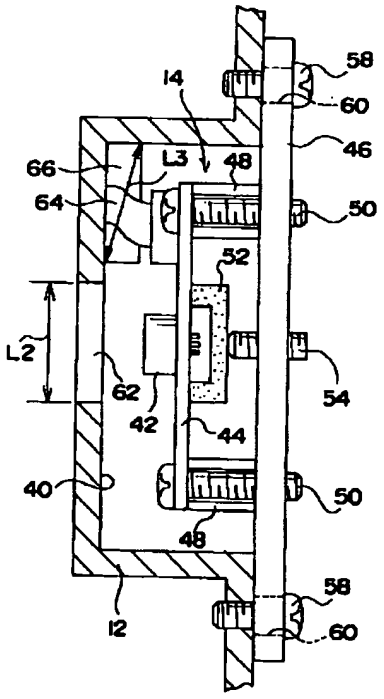
(54)【発明の名称】　光学走査装置

(57)【要約】
【課題】　良好な光学特性を確保すると共に、不用電波の漏洩を防止する光学走査装置を提供することを目的とする。
【解決手段】光学箱１２の外側に形成された凹部４０に取り付けられる光源装置１４は、半導体レーザ４２が実装された回路基板４４を保持部材４６に固定して一体化し、保持部材４６が固定ネジ５８によって光学箱１２に仮固定される。この状態で、調整ネジ５４を回動することによってフォーカス調整を行い、固定ネジ５８を緩めて保持部材４６を光軸に垂直な方向に変位させることによってアライメント調整を行う。これによって取付誤差などの影響を受けず所望の光学特性を有する光学走査装置とすることができる。なお、半導体レーザ４２および回路基板４４は、導電性を有する光学箱１２、保持部材４６、カバーによって略密封されているため、不用電波の漏洩が防止される。



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【特許請求の範囲】

【請求項１】　光学部品が取り付けられる導電性の光学箱と、

光ビームを出射する半導体レーザが実装された半導体レーザ駆動回路基板と、

前記半導体レーザ駆動回路基板を保持し、前記光学箱の側壁に固定される導電性の保持部材と、

前記保持部材の外側から操作可能で、前記半導体レーザ駆動回路基板を前記光ビームの光軸方向および光軸に垂直な方向に変位させる変位手段と、

を備え、前記半導体レーザ駆動回路基板が前記光学箱と前記保持部材によって略密封されることを特徴とする光学走査装置。

【請求項２】　光学部品が取り付けられる導電性の光学箱と、

前記光学箱の側壁に固定され、光ビームを出射する半導体レーザが実装される第１面が部品実装面および回路パターン面とされると共に、下記式（１）の関係を満たす切欠を設けて撓み可能とされた導電性の半導体レーザ駆動回路基板と、

前記半導体レーザ駆動回路基板の前記第１面と反対側の第２面側に設けられ、当該半導体レーザ駆動回路基板を前記光ビームの光軸方向および光軸に垂直な方向に変位させる変位手段と、

を備え、前記半導体レーザ駆動回路基板の第１面が当該半導体レーザ駆動回路基板と前記光学箱とによって略密封されることを特徴とする光学走査装置。

Ｌ１≦ｖ／（ｆ×１００）　　（１）

ここで、Ｌ１は切欠の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）

【請求項３】　前記光学箱に、前記半導体レーザから出射される光ビームを光学箱内部に導く下記式（２）の関係を満たす出射窓が形成されていることを特徴とする請求項１または２記載の光学走査装置。

Ｌ２≦ｖ／（ｆ×１００）　　（２）

ここで、Ｌ２は出射窓の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）

【請求項４】　前記光学箱に、前記半導体レーザ駆動回路基板に駆動信号を伝達する信号線を外部から接続する下記式（３）の関係を満たす信号線窓が形成されていることを特徴とする請求項１～３のいずれか１項記載の光学走査装置。

Ｌ３≦ｖ／（ｆ×１００）　　（３）

ここで、Ｌ３は信号線窓の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）

【発明の詳細な説明】

【０００１】

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【発明の属する技術分野】本発明は、デジタル複写機やプリンタ等の画像形成装置において使用され、画像信号を感光体ドラム上に光学像として走査露光するための光学走査装置に関し、一層詳細には、光学系を構成する電子部品から外部に漏れる不要電波を遮蔽する光学走査装置に関する。

【０００２】

【従来の技術】近年、レーザプリンタ等の画像記録装置の発達に伴い、半導体レーザを光源として用いた光学走査装置が使用されるようになった。一例として特開平５－２９７３０３号公報に開示された光学走査装置（以下、従来例という）を図９、図１０に示す。図９に示すように、光学走査装置１００は、光学箱１０２に固定された光源装置１０４からの出射される光ビームをコリメートレンズ１０６（図１０参照）等によって平行光束とした後、回転多面鏡からなる偏向器１０８によって偏向させる。偏向された光ビームは集光レンズ１１０によって感光体ドラム１１２の被走査面上に結像させる。

【０００３】このように構成される光学走査装置１００では、予め調整しておいた光源装置１０４を光学箱１０２の壁面に取り付けるのが従来一般的であった。しかしながら、この場合には、取り付け誤差や集光レンズ等の精度、光学箱１０２の精度によって光学走査装置１００が所望の光学特性を確保できないという問題があった。

【０００４】この問題を解決するために、従来例に係る光学走査装置１００では、光源装置１０４を光学箱１０２の外側に仮組み付けする。この状態で、光学走査装置１００を感光体ドラム上に相当する位置に配置して光学特性をモニタしながら、半導体レーザ１１４の位置を調整ネジ１１６によって調整する。このように、光学装置１０４を光学箱１０２に仮組み付け後、光学装置１０４の調整を行うことににによって、光学走査装置１００が所望の光学特性を確保できる。

【０００５】

【発明が解決しようとする課題】近年、オフィス等で使用されるデジタル複写機、プリンタ、ファクシミリ、ワードプロセッサ、パーソナルコンピュータなど電子機器の普及により、前記電子機器から発生する不要電波が問題となってきている。このため、電子機器からの発生する不要電波に対する規制を図るために、わが国においてＶＣＣＩ（情報処理装置等電波障害自主規制協議会）と呼ばれる電子機器メーカーの自主規制基準や、ドイツのＶＤＥ（ドイツ電気技術者協会）やアメリカのＦＣＣ（米国連邦通信委員会）等の法律規制が設けられている。

【０００６】一方、画像記録装置は高速化、高解像度化が求められており、光源の駆動周波数の増大により不用電波の漏洩防止が困難になってきている。

【０００７】特に、従来例に係る光学走査装置１００では、仮組み付け後に調整するために半導体レーザ駆動回

路基板１１６が光学箱１０２の外側に取り付けられる構造のため、また、光源装置１０４の金属部品１２２、１２４、１２６の側に信号線１２０が位置することによって金属部品１２２、１２４、１２６がアンテナとして作用するため、不用電波が漏洩しやすいという問題があった。

【０００８】本発明は、上記不都合を解決すべく成されたもので、良好な光学特性を確保すると共に、不用電波の漏洩を防止する光学走査装置を提供することを目的とする。

【０００９】

【課題を解決するための手段】上記目的を達成するために、請求項１記載の光学走査装置は、光学部品が取り付けられる導電性の光学箱と、光ビームを出射する半導体レーザが実装された半導体レーザ駆動回路基板と、前記半導体レーザ駆動回路基板を保持し、前記光学箱の側壁に固定される導電性の保持部材と、前記保持部材の外側から操作可能で、前記半導体レーザ駆動回路基板を前記光ビームの光軸方向および光軸に垂直な方向に変位させる変位手段と、を備え、前記半導体レーザ駆動回路基板が前記光学箱と前記保持部材によって略密封されることを特徴とする。

【００１０】請求項１記載の光学走査装置の作用について説明する。

【００１１】この光学装置装置は、以下のようにして光路調整を行う。すなわち、半導体レーザが実装された半導体レーザ駆動回路基板を保持する保持部材を光学箱に固定（仮組み立て）する。この状態で、光学走査装置の光学特性をモニタしつつ保持部材の外部から変位手段を操作し、半導体レーザ駆動回路基板（半導体レーザ）を光軸方向および光軸に垂直な方向に変位させることによって光学特性を調整し、光学走査装置を所望の光学特性に調整する。

【００１２】一方、半導体レーザおよび半導体レーザ駆動回路基板等の不用電波の発信源は、導電性の光学箱および保持部材によって略密封されるため、不要電波の漏洩が防止される。

【００１３】請求項２記載の光学走査装置は、光学部品が取り付けられる導電性の光学箱と、前記光学箱の側壁に固定され、光ビームを出射する半導体レーザが実装される第１面が部品実装面および回路パターン面とされると共に、下記式（１）の関係を満たす切欠を設けて撓み可能とされた導電性の半導体レーザ駆動回路基板と、前記半導体レーザ駆動回路基板の前記第１面と反対側の第２面側に設けられ、当該半導体レーザ駆動回路基板を前記光ビームの光軸方向および光軸に垂直な方向に変位させる変位手段と、を備え、前記半導体レーザ駆動回路基板の第１面が当該半導体レーザ駆動回路基板と前記光学箱とによって略密封されることを特徴とする。

【００１４】$L1 \leqq v/(f \times 100)$　（１）

ここで、Ｌ１は切欠の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）

請求項２記載の光学走査装置の作用について説明する。

【００１５】この光学装置装置では、以下のようにして光路調整を行う。すなわち、半導体レーザが実装された半導体レーザ駆動回路基板を光学箱に固定（仮組み立て）する。この状態で、光学走査装置の光学特性をモニタしつつ保持部材の外部から変位手段を操作し、半導体レーザ駆動回路基板（半導体レーザ）を光軸方向あるいは光軸に垂直な方向に変位させることによって光学特性を調整し、光学走査装置を所望の光学特性に調整する。

【００１６】なお、上記変位を行う際、半導体レーザ駆動回路基板に切欠が設けてあるため、前記基板が撓みやすくなると共に応力集中を防止できる。

【００１７】一方、半導体レーザおよび回路パターン等の不用電波の発信源は半導体レーザ駆動回路基板の第１面に設けられており、前記第１面が導電性の光学箱および半導体レーザ駆動回路基板の第２面によって略密封されるため、不要電波の漏洩が防止される。

【００１８】ところで、シールド部材に形成された開口部の大きさは、不用電波の波長λの１／１００程度にしなければ十分なシールド効果が得られないことが知られている（電子技術１９８８年９月号）。そこで、最大長さＬ１が上記式（１）の関係を満たすような切欠を半導体レーザ駆動回路基板に形成することによって、切欠から不用電波が漏洩することを十分にシールドすることができる。

【００１９】請求項３記載の光学走査装置は、請求項１または２記載の光学走査装置において、前記光学箱に、前記半導体レーザから出射される光ビームを光学箱内部に導く下記式（２）の関係を満たす出射窓が形成されていることを特徴とする。

【００２０】$L2 \leqq v/(f \times 100)$　（２）

ここで、Ｌ２は出射窓の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）

請求項３記載の光学走査装置の作用について説明する。

【００２１】光学箱に形成された光ビーム用の出射窓の最大長さＬ２が上記式（２）の関係を満たすため、出射窓からの不用電波の漏洩が請求項２記載の光学走査装置と同様にして防止される。

【００２２】請求項４記載の光学走査装置は、請求項１～３のいずれか１項記載の光学走査装置前記光学箱に、前記半導体レーザ駆動回路基板に駆動信号を伝達する信号線を外部から接続する下記式（３）の関係を満たす信号線窓が形成されていることを特徴とする。

【００２３】$L3 \leqq v/(f \times 100)$　（３）

ここで、Ｌ３は信号線窓の最大長さ（ｍ）

ｖは空気中の光速（ｍ／ｓ）

ｆは半導体レーザの駆動周波数（Ｈｚ）
請求項４記載の光学走査装置の作用について説明する。
【００２４】光学箱に形成された半導体レーザ駆動回路基板用の信号線窓の最大長さＬ３が上記式（３）の関係を満たすため、信号線窓からの不用電波の漏洩が請求項２記載の光学走査装置と同様にして防止される。
【００２５】
【発明の実施の形態】［第１実施形態］本発明の第１実施形態に係る光学走査装置について図１～図４を参照して説明する。先ず、光学走査装置の概略説明を行い、次に要部である光源装置について詳細な説明を行う。
（光学走査装置の概略説明）図２に示すように、光学走査装置１０では、光学箱１２の壁面外部に取り付けられた光源装置１４から出射される光ビームがコリメートレンズ１６によって平行光束とされ、平行光束とされた光ビームがシリンドリカルレンズ１８、反射ミラー２０を介して回転多面鏡２２に入射され、反射面２４上に線状に結像される。回転多面鏡２２によって偏向された光ビームは、結像レンズ２６、２８によって集光され、反射ミラー３０、３２を介して感光体ドラム３４上に結像される。
（光源装置の説明）光源装置１４は、図３に示すように、光学箱１２の側壁に設けられた上部と横の２方向に開口した凹部４０に取り付けられるものである。
【００２６】光源装置１４は、図１および図３に示すように、光ビームを出射する半導体レーザ４２と、半導体レーザ４２が実装される半導体レーザ駆動回路基板（以下、回路基板という）４４と、回路基板４４を保持する保持部材４６とから基本的に構成される。
【００２７】回路基板４４は、スペーサ４８を介して固定ネジ５０によって保持部材４６に固定されている。なお、回路基板４４の裏側には、半導体レーザ４２の端子を外部から保護するカバー部材５２が設けられており、保持部材４６に取り付けられた調整ネジ５４が当接している。
【００２８】ここで、スペーサ４８は、所定の長さよりも若干短く形成してあるため、調整ネジ５４を回動することによって回路基板４４（半導体レーザ４２）を光ビームの光軸方向（図４矢印Ａ方向）に変位可能である。
【００２９】保持部材４６は、固定ネジ５８よりも径の大きい孔部６０に固定ネジ５８を挿通することによって、光学箱１２の壁面に固着される。
【００３０】この際、凹部４０に形成された出射窓６２が対向した位置に半導体レーザ４２が配置され、光ビームを光学箱内部に出射可能とされる。また、回路基板４４に外部から駆動信号を伝達する信号線６４が挿入される信号線窓（孔部）６６が凹部４０に形成されている。
【００３１】このように構成された光学走査装置１０（光源装置１４）は、以下のような作用がある。
【００３２】先ず、光路調整について説明する。光路調整する場合には、半導体レーザ４２が実装された回路基板４４を保持部材４６に固定して光源装置１４を組み立てる。この後、固定ネジ５８によって保持部材４６を光学箱１２の壁面外側に仮固定し、回路基板４４を凹部４０内部に配置する。さらに、光学箱１２の上部にカバー６８を取り付けて凹部４０に配置された回路基板４４を光学箱１２、カバー６８、保持部材４６で略密閉する。この際、信号線６４は、信号線窓６６から凹部４０の内部に進入し、回路基板４４と外部とを接続している。
【００３３】この状態で光学箱１２を感光体ドラム３４の仮想位置でモニタしながら光路調整を行う。フォーカス調整は調整ネジ５４を回動することによってカバー部材５２を介して回路基板４４を押圧することによって半導体レーザ４２を光軸方向に移動させて行う。
【００３４】一方、アライメント調整は、固定ネジ５８を緩めて、孔部６０内で保持部材４６を光軸と垂直方向（図４Ｘ、Ｙ方向）に変位させることによって行う。この結果、半導体レーザ４２のアライメント調整が行われる。
【００３５】このように、一旦、光学走査装置１０に光源装置１４を取り付けた後、光学特性をモニタしながら光学箱１２の外部からフォーカス調整およびアライメント調整が簡単にできるため、取付誤差や集光レンズ、光学箱１２等の製造精度に影響されることなく、所望の光学特性を有する光学走査装置１０とすることができる。
【００３６】次に、不用電波の遮蔽について説明する。光学箱１２、光学箱１２のカバー６８および保持部材４６が導電性を有する材料（金属、カーボンフィラー含有プラスチック、金属フィラー含有プラスチック、導電性塗装プラスチック等）から形成されており、それぞれが電気的に接続されて、本体グラウンドに設置されている。したがって、光学箱１２、カバー６８および保持部材４６で略密閉される半導体レーザ４２および回路基板４４等から発生する不要電波が外部に漏洩することを防止できる。
【００３７】また、矩形状に形成された信号線窓６６の対角線長さ（最大長さ）Ｌ３（ｍ）、円形に形成された出射窓６２の直径（最大長さ）Ｌ２（ｍ）は、半導体レーザ駆動周波数ｆ（Ｈｚ）、空気中の光速ｖ（ｍ／ｓ）とすると、Ｌ３≦ｖ／（ｆ×１００）、Ｌ２≦ｖ／（ｆ×１００）の関係をみたすように形成されている。ここで、一般的に電波の遮蔽（シールド）が十分に効果をあげるためには、開口部の大きさが電波の波長λの１／１００程度にしなければならないことが知られている（電子技術１９８８年９月号）。信号線窓６６、出射窓６２がこの条件を満たしているために、信号線窓６６、出射窓６２から凹部４０の外部へ不用電波が漏洩することを防止できる。
［第２実施形態］次に、第２実施形態に係る光学走査装置について図５を参照して説明する。第１実施形態と同

様な構成要素には同一の参照符号を付し、その詳細な説明を省略する。第1実施形態と異なるのは光学装置の一部のみなので、光学装置についてのみ説明を行う。

【0038】光源装置70において、光源装置14と異なる点は、回路基板44と保持部材46の間に挿入していたスペーサ48を省き、固定ネジ50のねじ山と回路基板44の間にスプリング72を挿入したことである。

【0039】このように構成された光源装置70では、第1実施形態と同様にして光路調整が行われる。この際、フォーカス調整において調整ネジ54を回動させて回路基板44を変位させた場合にスプリング72が弾性変形することで、回路基板44の変形（撓み）を抑制する。したがって、回路基板44の光軸方向の移動量が大きい場合でも回路基板44が変形（撓む）ことなく、回路基板44の実装部品の破損やハンダ剥がれ等の問題が発生することを確実に回避できる。

［第3実施形態］次に、第2実施形態に係る光学走査装置について図6、図7を参照して説明する。第2実施形態と同様な構成要素には同一の参照符号を付し、その詳細な説明を省略する。第2実施形態と異なるのは光学装置の一部のみなので、光学装置についてのみ説明を行う。

【0040】光源装置80において、光源装置70と異なる点は、保持部材を省き、回路基板82を板金で形成し、片面（以下、第1面という）82Aに半導体レーザを実装し、当該第1面82Aに回路パターンの形成と部品の実装を行っている。第1面82Aの反対側の第2面82Bには、調整部材84が取り付けられており、調整ネジ54によって回路基板82を光軸方向に変形させるようになっている。なお、回路基板82には、切欠86が複数形成され、前記調整ネジ54によって光軸方向に変形（撓み）可能に形成されている。

【0041】このように構成された光源装置14の作用について説明する。

【0042】先ず、調整部材84が取り付けられた回路基板82の孔部60に図示しない固定ネジを挿通して、回路基板82を光学箱12の壁面に仮固定する。この状態で第2実施形態と同様にしてフォーカス調整とアライメント調整を行う。但し、フォーカス調整は、調整ネジ54を回動させることによって、回路基板82を直接変形させるものであり、アライメント調整も孔部60の範囲内で回路基板82を光軸に垂直な方向に移動させるものである。

【0043】次に、不用電波の遮蔽について説明する。

【0044】回路基板82の第1面に半導体レーザ、回路パターンの形成、部品の実装を行ったため、第1面と絶縁された導電性を有する回路基板の82の第2面82B、導電性を有する光学箱12、カバー68が電気的に接続され、本体グラウンドに設置されている。したがって、光学箱12、カバー68および回路基板82の第2面82Bで略密閉される半導体レーザおよび回路基板82の第1面82A等から発生する不要電波が外部に漏洩することを防止できる。

【0045】また、矩形状に形成された切欠86の対角線の長さ（最大長さ）L1（m）（図7参照）は、半導体レーザ駆動周波数f（Hz）、空気中の光速v（m/s）とすると、$L1 \leqq v/(f \times 100)$の関係をみたすように形成されている。したがって、切欠86から凹部40の外部へ不用電波が漏洩することを防止できる。

【0046】このように本実施形態の光源装置80は、回路基板82にシールド部材と弾性部材の役割を兼用させたため、部品点数が減少して低コストで不用電波の漏洩防止と良好な光学特性を確保することができる。

【0047】なお、第1実施形態に係る光源装置14が固着される光学箱12の凹部40は、上部と横の2方向に開口したものであったが、凹部が1方向（横方向）のみに開口するものにしても良い（図8参照）。凹部40をこのように形成することによって、カバー68が無くとも不用電波に対する同様のシールド効果を得ることができる。

【0048】

【発明の効果】本発明に係る光学走査装置では、仮組み付け後に光源装置の調整が行えるため、優れた光学特性を確保することができると共に、不用電波の漏洩を確実に防止できる。

【図面の簡単な説明】

【図1】　本発明の第1実施形態に係る光学走査装置の光源装置の取付状態を示す断面図である。

【図2】　本発明の実施形態に係る光学走査装置の概略説明斜視図である。

【図3】　本発明の第1実施形態に係る光源装置の分解斜視図である。

【図4】　本発明の第1実施形態に係る光源装置の取付状態を示す一部断面斜視図である。

【図5】　本発明の第2実施形態に係る光源装置を示す側面図である。

【図6】　本発明の第3実施形態に係る光源装置の要部分解斜視図である。

【図7】　本発明の第3実施形態に係る切欠の最大長さ説明図である。

【図8】　本発明の実施形態に係る凹部の他の例を示す斜視図である。

【図9】　従来例に係る光学走査装置を示す概略斜視図である。

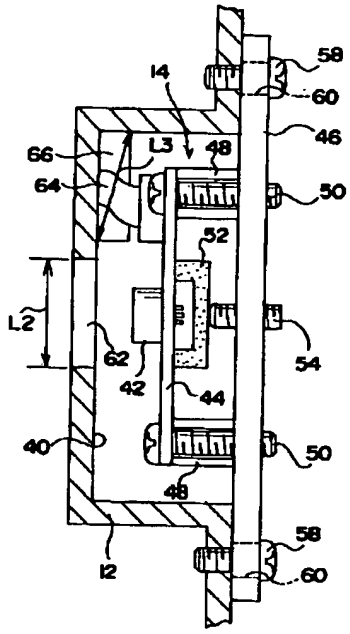
【図10】　従来例に係る光学走査装置の光源装置の取付状態を示す断面図である。

【符号の説明】

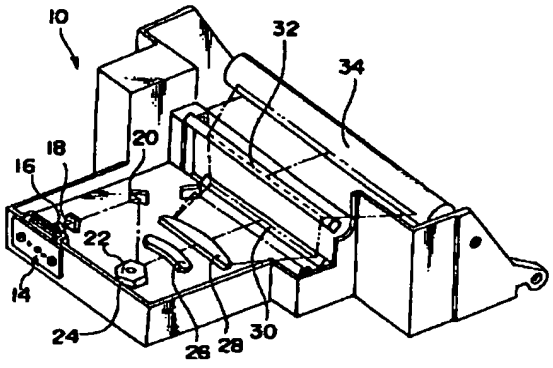
10、70、80　光学走査装置
12　光学箱
42　半導体レーザ

44、82　半導体レーザ駆動回路基板
46　保持部材
54　調整ネジ（変位手段）
58　固定ネジ（変位手段）
60　孔部（変位手段）
62　出射窓
66　信号線窓
86　切欠

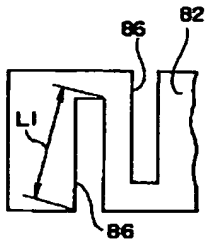
【図1】



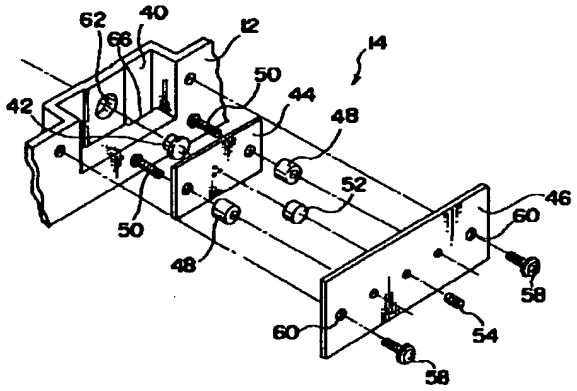
【図2】



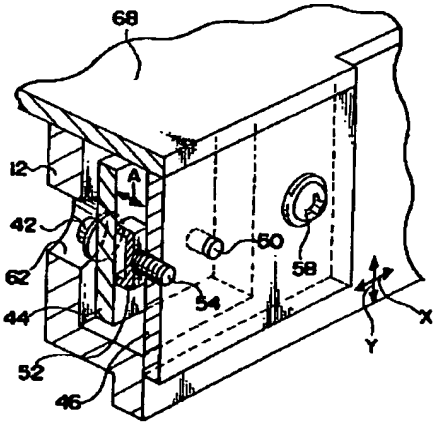
【図7】



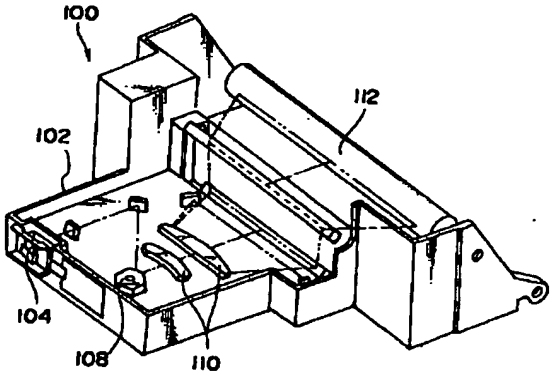
【図3】



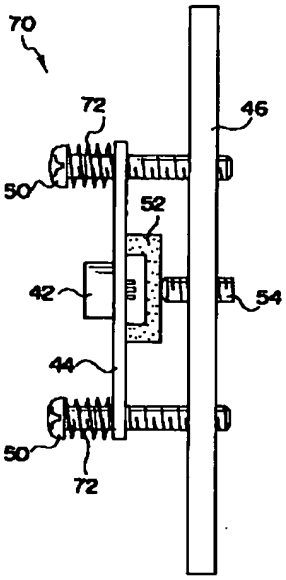
【図4】



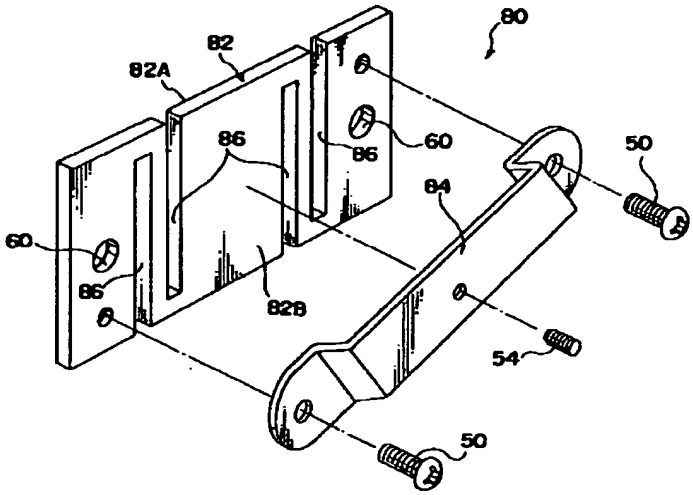
【図9】



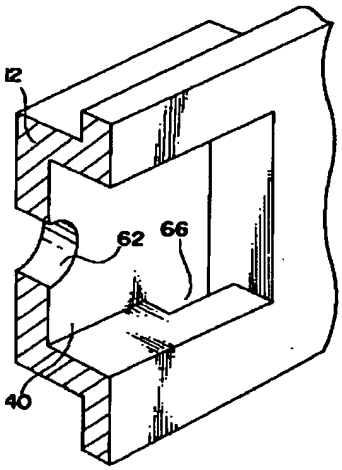
【図5】


70
72
46
50
52
42
54
44
50
72

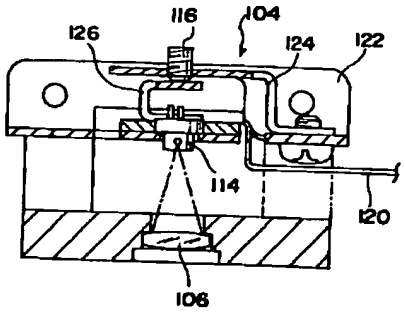
【図6】


80
82
82A
86
86
60
50
84
60
86
82B
54
50

【図8】


12
62
66
40

【図10】


116
104
126
124
122
114
120
106

PATENT ABSTRACTS OF JAPAN

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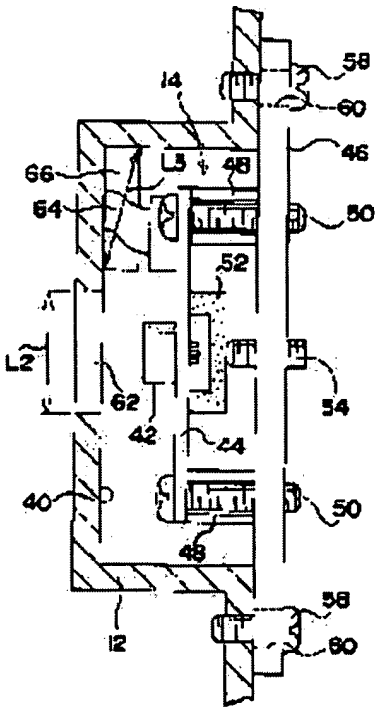
(54) OPTICAL SCANNER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical scanner capable of securing good optical characteristics and also preventing the leakage of an unnecessary radio wave.

SOLUTION: In a light source device 14 to be attached to a recessed part 40 formed outside an optical box 12, a circuit board 44 on which a semiconductor laser 42 is mounted is fixed to and integrated with a holding member 46 to fix the member 46 temporarily to the box 2 by a fixing screw 58. In this state, focusing adjustment is performed by turning an adjustment screw 54, the screw 58 is loosened, and the member 46 is displaced in a direction perpendicular to an optical axis to perform aligning adjustment. Thus, the optical scanner having the desired optical characteristics without being affected by attachment error, etc., can be obtained. Also, since the laser 42 and the board 44 are nearly hermetically sealed by the box 12, the member 46 and a cover which have conductivity, the leakage of the unnecessary radio wave can be prevented.



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CLAIMS

[Claim(s)]
[Claim 1] The conductive optical box with which an optic is attached, and the semiconductor laser drive circuit board in which the semiconductor laser which carries out outgoing radiation of the light beam was mounted, Are operational from the conductive attachment component which holds said semiconductor laser drive circuit board, and is fixed to the side attachment wall of said optical box, and the outside of said attachment component. The optical scanner characterized by having the displacement means to which the variation rate of said semiconductor laser drive circuit board is made to carry out in the direction of an optical axis of said light beam, and the direction perpendicular to an optical axis, and abbreviation seal of said semiconductor laser drive circuit board being carried out by said optical box and said attachment component.
[Claim 2] While the 1st page in which the semiconductor laser which is fixed to the side attachment wall of the conductive optical box with which an optic is attached, and said optical box, and carries out outgoing radiation of the light beam is mounted is made into a component side and a circuit pattern side The conductive semiconductor laser drive circuit board of which prepared notching which fills the relation of the following type (1), and bending was made possible, The displacement means to which it is prepared in the said 1st page [of said semiconductor laser drive circuit board], and 2nd page side of the opposite side, and the variation rate of the semiconductor laser drive circuit board concerned is made to carry out in the direction of an optical axis of said light beam, and the direction perpendicular to an optical axis, The optical scanner characterized by carrying out abbreviation seal of the 1st page of a preparation and said semiconductor laser drive circuit board with the semiconductor laser drive circuit board and said optical box concerned.
$L1 <= v/(fx100)$ (1)
Here, L1 is the length between couplings (m) of notching.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.
[Claim 3] The optical scanner according to claim 1 or 2 characterized by forming the outgoing radiation aperture which fills the relation of the following type (2) which leads the light beam by which outgoing radiation is carried out to said optical box from said semiconductor laser to the interior of an optical box.
$L2 <= v/(fx100)$ (2)
Here, L2 is the length between couplings (m) of an outgoing radiation aperture.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.
[Claim 4] The optical scanner of claims 1-3 characterized by forming the signal-line aperture which fills the relation of the following formula (3) which connects to said optical box from the outside the signal line which transmits a driving signal to said semiconductor laser drive circuit board given in any 1 term.
$L3 <= v/(fx100)$ (3)
Here, L3 is the length between couplings (m) of a signal-line aperture.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used in image formation equipments, such as a digital copier and a printer, and relates to the optical scanner which covers the unnecessary electric wave which leaks outside from the electronic parts which constitute optical system in a detail further about the optical scanner for carrying out scan exposure of the picture signal as an optical image at photo conductor drum lifting.
[0002]
[Description of the Prior Art] In recent years, the optical scanner using semiconductor laser as the light source came to be used with development of image recording equipments, such as a laser beam printer. The optical scanner (henceforth the conventional example) indicated by JP,5-297303,A as an example is shown in drawing 9 and drawing 10 . As shown in drawing 9 , after an optical scanner 100 makes the light beam of the light equipment 104 fixed to the optical box 102 by which outgoing radiation is carried out the parallel flux of light with a collimate lens 106 (refer to drawing 10) etc., it is deflected with the deflecting system 108 which consists of a rotating polygon. Image formation of the deflected light beam is carried out on the scan layer-ed of the photo conductor drum 112 with a condenser lens 110.
[0003] Thus, it was conventionally common to have attached in the wall surface of the optical box 102 the light equipment 104 adjusted beforehand in the optical scanner 100 constituted. However, there was a problem that an optical scanner 100 could not secure a desired optical property with the precision of an installation error, a condenser lens, etc. and the precision of the optical box 102, in this case.
[0004] In order to solve this problem, in the optical scanner 100 concerning the conventional example, temporary-assembling attachment of the light equipment 104 is carried out on the outside of the optical box 102. A stretching screw 116 adjusts the location of semiconductor laser 114, arranging an optical scanner 100 in the location equivalent to photo conductor drum lifting, and carrying out the monitor of the optical property in this condition. Thus, the optical property of the request of an optical scanner 100 by look optical equipment 104 like [the optical box 102] performing adjustment of optical equipment 104 after temporary-assembling attachment is securable.
[0005]
[Problem(s) to be Solved by the Invention] In recent years, the unnecessary electric wave generated from said electronic equipment is posing a problem by the spread of electronic equipment, such as a digital copier used in office etc., a printer, facsimile, a word processor, and a personal computer. For this reason, in order to aim at regulation on the unnecessary electric wave generated from electronic equipment, the law regulation of an electronic maker's self-imposed control criteria, VDE (German institution of electrical engineers) of Germany, FCC (Federal Communications Commission) in the United States, etc. called VCCI (Voluntary Control Council for Interference by Information Techonology Equipment) in our country is prepared.
[0006] On the other hand, improvement in the speed and high resolution-ization are called for and, as for image recording equipment, the leakage control of a unnecessary electric wave is becoming difficult according to increase of the drive frequency of the light source.
[0007] Especially in the optical scanner 100 concerning the conventional example, when a signal line 120 was located in the metal components 122, 124, and 126 side of light equipment 104, in order that [for the structure where the semiconductor laser drive circuit board 116 is attached in the outside of the optical box 102 in order to adjust after temporary-assembling attachment] the metal components 122, 124, and 126 might act as an antenna, there was a problem of being easy to reveal a unnecessary electric wave.

[0008] This invention aims at offering the optical scanner which prevents leakage of a unnecessary electric wave while it was accomplished that it should solve above-mentioned un-arranging and secures a good optical property.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, an optical scanner according to claim 1 The conductive optical box with which an optic is attached, and the semiconductor laser drive circuit board in which the semiconductor laser which carries out outgoing radiation of the light beam was mounted, Are operational from the conductive attachment component which holds said semiconductor laser drive circuit board, and is fixed to the side attachment wall of said optical box, and the outside of said attachment component. It has the displacement means to which the variation rate of said semiconductor laser drive circuit board is made to carry out in the direction of an optical axis of said light beam, and the direction perpendicular to an optical axis, and is characterized by abbreviation seal of said semiconductor laser drive circuit board being carried out by said optical box and said attachment component.
[0010] An operation of an optical scanner according to claim 1 is explained.
[0011] As this optical equipment equipment is the following, it performs optical-path adjustment. That is, the attachment component holding the semiconductor laser drive circuit board in which semiconductor laser was mounted is fixed to an optical box (temporary assembly). In this condition, a displacement means is operated from the exterior of an attachment component, carrying out the monitor of the optical property of an optical scanner, by making the variation rate of the semiconductor laser drive circuit board (semiconductor laser) carry out in the direction of an optical axis, and the direction perpendicular to an optical axis, an optical property is adjusted and an optical scanner is adjusted to a desired optical property.
[0012] On the other hand, since abbreviation seal of the source of dispatch of unnecessary electric waves, such as semiconductor laser and the semiconductor laser drive circuit board, is carried out by a conductive optical box and a conductive attachment component, leakage of an unnecessary electric wave is prevented.
[0013] While the 1st page in which the semiconductor laser which an optical scanner according to claim 2 is fixed to the side attachment wall of the conductive optical box with which an optic is attached, and said optical box, and carries out outgoing radiation of the light beam is mounted is made into a component side and a circuit pattern side The conductive semiconductor laser drive circuit board of which prepared notching which fills the relation of the following type (1), and bending was made possible, The displacement means to which it is prepared in the said 1st page [of said semiconductor laser drive circuit board], and 2nd page side of the opposite side, and the variation rate of the semiconductor laser drive circuit board concerned is made to carry out in the direction of an optical axis of said light beam, and the direction perpendicular to an optical axis, It is characterized by carrying out abbreviation seal of the 1st page of a preparation and said semiconductor laser drive circuit board with the semiconductor laser drive circuit board and said optical box concerned.
[0014] $L1 <= v/(fx100)$ (1)
Here, L1 is the length between couplings (m) of notching.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.
An operation of an optical scanner according to claim 2 is explained.
[0015] With this optical equipment equipment, as it is the following, optical-path adjustment is performed. That is, the semiconductor laser drive circuit board in which semiconductor laser was mounted is fixed to an optical box (temporary assembly). In this condition, a displacement means is operated from the exterior of an attachment component, carrying out the monitor of the optical property of an optical scanner, by making the variation rate of the semiconductor laser drive circuit board (semiconductor laser) carry out in the direction of an optical axis, or the direction perpendicular to an optical axis, an optical property is adjusted and an optical scanner is adjusted to a desired optical property.
[0016] In addition, since notching is prepared in the semiconductor laser drive circuit board in case the above-mentioned displacement is performed, stress concentration can be prevented while said substrate becomes easy to bend.
[0017] On the other hand, the source of dispatch of the unnecessary electric wave of semiconductor laser, a circuit pattern, etc. is established in the 1st page of the semiconductor laser drive circuit board, and since abbreviation seal is carried out by the 2nd page of the optical box of conductivity the 1st page, and said semiconductor laser drive circuit board, leakage of an unnecessary electric wave is prevented.

[0018] By the way, if magnitude of opening formed in the shielding member is not made about [of the wavelength lambda of a unnecessary electric wave] into 1/100, it is known that sufficient shielding effect will not be obtained (the electronic technical September, 1988 issue). then -- maximum length -- it can fully shield that a unnecessary electric wave is revealed from notching by forming in the semiconductor laser drive circuit board notching with which L1 fills the relation of the above-mentioned formula (1).
[0019] An optical scanner according to claim 3 is characterized by forming the outgoing radiation aperture which fills the relation of the following type (2) which leads the light beam by which outgoing radiation is carried out to said optical box from said semiconductor laser to the interior of an optical box in an optical scanner according to claim 1 or 2.
[0020] L2<=v/(fx100) (2)
Here, L2 is the length between couplings (m) of an outgoing radiation aperture.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.
An operation of an optical scanner according to claim 3 is explained.
[0021] In order that the length between couplings L2 of the outgoing radiation aperture for light beams formed in the optical box may fill the relation of the above-mentioned formula (2), leakage of the unnecessary electric wave from an outgoing radiation aperture is prevented like an optical scanner according to claim 2.
[0022] An optical scanner according to claim 4 is characterized by forming the signal-line aperture which fills the relation of the following formula (3) which connects to the optical scanner aforementioned optical box of claim 1-3 given in any 1 term from the outside the signal line which transmits a driving signal to said semiconductor laser drive circuit board.
[0023] L3<=v/(fx100) (3)
Here, L3 is the length between couplings (m) of a signal-line aperture.
v is the velocity of light (m/s) in air.
f is the drive frequency (Hz) of semiconductor laser.
An operation of an optical scanner according to claim 4 is explained.
[0024] In order that the length between couplings L3 of the signal-line aperture for the semiconductor laser drive circuit boards formed in the optical box may fill the relation of the above-mentioned formula (3), leakage of the unnecessary electric wave from a signal-line aperture is prevented like an optical scanner according to claim 2.
[0025]
[Embodiment of the Invention] The optical scanner concerning the 1st operation gestalt of [1st operation gestalt] this invention is explained with reference to drawing 1 - drawing 4 . First, the approximate account of an optical scanner is performed and explanation detailed about the light equipment which is next an important section is given.
(Approximate account of an optical scanner) As shown in drawing 2 , in an optical scanner 10, incidence of the light beam by which the light beam by which outgoing radiation is carried out from the light equipment 14 attached in the wall surface exterior of the optical box 12 was made the parallel flux of light, and was made the parallel flux of light with the collimate lens 16 is carried out to a rotating polygon 22 through a cylindrical lens 18 and the reflective mirror 20, and image formation is carried out to a line on a reflector 24. It is condensed with the image formation lenses 26 and 28, and image formation of the light beam deflected by the rotating polygon 22 is carried out on the photo conductor drum 34 through the reflective mirrors 30 and 32.
(Explanation of light equipment) Light equipment 14 is attached in the crevice 40 which carried out opening to the 2-way of the upper part established in the side attachment wall of the optical box 12, and width as shown in drawing 3 .
[0026] Light equipment 14 consists of fundamentally attachment components 46 holding the semiconductor laser 42 which carries out outgoing radiation of the light beam, the semiconductor laser drive circuit board (henceforth the circuit board) 44 in which semiconductor laser 42 is mounted, and the circuit board 44, as shown in drawing 1 and drawing 3 .
[0027] The circuit board 44 is being fixed to the attachment component 46 with the fixed screw 50 through the spacer 48. In addition, the covering member 52 which protects the terminal of semiconductor laser 42 from the exterior is formed in the background of the circuit board 44, and the stretching screw 54 attached in the attachment component 46 has contacted.

[0028] Here, since the spacer 48 is short formed a little rather than predetermined die length, it can displace the circuit board 44 (semiconductor laser 42) by rotating a stretching screw 54 in the direction of an optical axis of a light beam (the direction of drawing 4 arrow-head A).
[0029] An attachment component 46 fixes on the wall surface of the optical box 12 by inserting the fixed screw 58 in the pore 60 with a larger path than the fixed screw 58.
[0030] Under the present circumstances, semiconductor laser 42 is arranged in the location where the outgoing radiation aperture 62 formed in the crevice 40 countered, and outgoing radiation of a light beam is made possible inside an optical box. Moreover, the signal-line aperture (pore) 66 in which the signal line 64 which transmits a driving signal to the circuit board 44 from the exterior is inserted is formed in the crevice 40.
[0031] Thus, the constituted optical scanner 10 (light equipment 14) has the following operations.
[0032] First, optical-path adjustment is explained. In carrying out optical-path adjustment, the circuit board 44 in which semiconductor laser 42 was mounted is fixed to an attachment component 46, and it assembles light equipment 14. Then, with the fixed screw 58, temporary immobilization of the attachment component 46 is carried out on the wall surface outside of the optical box 12, and the circuit board 44 is arranged to the crevice 40 interior. Furthermore, abbreviation sealing of the circuit board 44 which attached covering 68 in the upper part of the optical box 12, and has been arranged in the crevice 40 is carried out by the optical box 12, covering 68, and the attachment component 46. Under the present circumstances, the signal line 64 advanced into the interior of a crevice 40 from the signal-line aperture 66, and has connected the circuit board 44 and the exterior.
[0033] Optical-path adjustment is performed carrying out the monitor of the optical box 12 in this condition in the virtual location of the photo conductor drum 34. Focal adjustment is performed by moving semiconductor laser 42 in the direction of an optical axis by pressing the circuit board 44 through the covering member 52 by rotating a stretching screw 54.
[0034] On the other hand, alignment adjustment loosens the fixed screw 58 and is performed by making the variation rate of the attachment component 46 carry out perpendicularly (drawing 4 X, the direction of Y) to an optical axis within a pore 60. Consequently, alignment adjustment of semiconductor laser 42 is performed.
[0035] Thus, it can consider as the optical scanner 10 which has a desired optical property, without once being influenced by the manufacture precision of installation-error, condenser lens, and optical box 12 grade, since focal adjustment and alignment adjustment can be simply performed from the exterior of the optical box 12, carrying out the monitor of the optical property after attaching light equipment 14 in an optical scanner 10.
[0036] Next, electric shielding of a unnecessary electric wave is explained. It is formed from the ingredient with which covering 68 and the attachment component 46 of the optical box 12 and the optical box 12 have conductivity (a metal, carbon filler content plastics, filler metal content plastics, conductive paint plastics, etc.), and it connects electrically and each is installed in the ground of a body. Therefore, it can prevent that the unnecessary electric wave generated from the semiconductor laser 42 and circuit board 44 grade by which abbreviation sealing is carried out by the optical box 12, covering 68, and the attachment component 46 is revealed outside.
[0037] Moreover, if it is the velocity of light v (m/s) in semiconductor laser drive frequency f (Hz) and air, the diagonal line die length (length between couplings) (m) L3 of the signal-line aperture 66 formed in the shape of a rectangle and the diameter (length between couplings) (m) L2 of the outgoing radiation aperture 62 formed circularly are formed so that the relation of L3<=v/(fx100) and L2 <=v/(fx100) may be filled. Here, in order for electric shielding (shielding) of an electric wave to fully obtain effectiveness generally, the thing [carry out / as for the wavelength lambda of an electric wave / to about 1/100 / the magnitude of opening] which it is kicked, and nothing is if it is ** is known (the electronic technical September, 1988 issue). Since the signal-line aperture 66 and the outgoing radiation aperture 62 fulfill this condition, it can prevent that a unnecessary electric wave is revealed from the signal-line aperture 66 and the outgoing radiation aperture 62 to the exterior of a crevice 40.
The optical scanner concerning the [2nd operation gestalt], next the 2nd operation gestalt is explained with reference to drawing 5 . The same reference mark is given to the same component as the 1st operation gestalt, and the detailed explanation is omitted. Since differing from the 1st operation gestalt is some optical equipments, only optical equipment is explained.
[0038] In light equipment 70, a different point from light equipment 14 is having excluded the spacer 48 which was being inserted between the circuit board 44 and an attachment component 46, and having inserted the spring 72 between the screw threads and the circuit boards 44 of the fixed screw 50.

[0039] Thus, in the constituted light equipment 70, optical-path adjustment is performed like the 1st operation gestalt. Under the present circumstances, deformation (bending) of the circuit board 44 is controlled because a spring 72 carries out elastic deformation when a stretching screw 54 is rotated in focal adjustment and the variation rate of the circuit board 44 is carried out. therefore -- case the movement magnitude of the direction of an optical axis of the circuit board 44 is large -- the circuit board 44 -- deformation (it bends) -- there are nothings and it can avoid certainly that problems, such as breakage of the mounting components of the circuit board 44 and pewter peeling, occur.
The optical scanner concerning the [3rd operation gestalt], next the 2nd operation gestalt is explained with reference to drawing 6 and drawing 7 . The same reference mark is given to the same component as the 2nd operation gestalt, and the detailed explanation is omitted. Since differing from the 2nd operation gestalt is some optical equipments, only optical equipment is explained.
[0040] In light equipment 80, a different point from light equipment 70 excludes an attachment component, forms the circuit board 82 with a sheet metal, mounts semiconductor laser in one side (henceforth 1st page) 82A, and is performing formation of a circuit pattern, and mounting of components to the 1st page 82A concerned. The controller material 84 is attached in 2nd page 82B of the opposite side of 1st page 82A, and the circuit board 82 is made to deform in the direction of an optical axis with a stretching screw 54. In addition, two or more formation is carried out and notching 86 is formed in the direction of an optical axis possible [deformation (bending)] by said stretching screw 54 at the circuit board 82.
[0041] Thus, an operation of the constituted light equipment 14 is explained.
[0042] First, the fixed screw which is not illustrated to the pore 60 of the circuit board 82 in which the controller material 84 was attached is inserted in, and temporary immobilization of the circuit board 82 is carried out at the wall surface of the optical box 12. Focal adjustment and alignment adjustment are performed like the 2nd operation gestalt in this condition. However, by rotating a stretching screw 54, focal adjustment is made to deform the circuit board 82 directly, and alignment adjustment also moves [adjustment] the circuit board 82 in the direction perpendicular to an optical axis within the limits of a pore 60.
[0043] Next, electric shielding of a unnecessary electric wave is explained.
[0044] Since formation of semiconductor laser and a circuit pattern and mounting of components were performed to the 1st page of the circuit board 82, it connects electrically and the optical box 12 and covering 68 which have 2nd page 82B of 82 of the circuit board which has the conductivity insulated with the 1st page, and conductivity are installed in the ground of a body. Therefore, it can prevent that the unnecessary electric wave generated from 1st page 82A of the semiconductor laser by which abbreviation sealing is carried out by the optical box 12, covering 68, and 2nd page 82B of the circuit board 82, and the circuit board 82 etc. is revealed outside.
[0045] Moreover, if it is the velocity of light v (m/s) in semiconductor laser drive frequency f (Hz) and air, the die length (length between couplings) (m) L1 of the diagonal line of the notching 86 formed in the shape of a rectangle and (referring to drawing 7) are formed so that the relation of L1 <=v/(fx100) may be filled. Therefore, it can prevent that a unnecessary electric wave is revealed from notching 86 to the exterior of a crevice 40.
[0046] Thus, since the light equipment 80 of this operation gestalt made the role of a shielding member and an elastic member use also [circuit board / 82], components mark can decrease and it can secure the leakage control of a unnecessary electric wave, and a good optical property by low cost.
[0047] In addition, although opening of the crevice 40 of the optical box 12 which the light equipment 14 concerning the 1st operation gestalt fixes was carried out to the 2-way of the upper part and width, its crevice is good only for one direction (longitudinal direction) as for what carries out opening (refer to drawing 8). there is no covering 68 by forming a crevice 40 in this way -- ** -- the same shielding effect to a unnecessary electric wave can be obtained.
[0048]
[Effect of the Invention] In the optical scanner concerning this invention, since light equipment can be adjusted after temporary-assembling attachment, while the outstanding optical property is securable, leakage of a unnecessary electric wave can be prevented certainly.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the attachment condition of the light equipment of the optical scanner concerning the 1st operation gestalt of this invention.
[Drawing 2] It is the approximate account perspective view of the optical scanner concerning the operation gestalt of this invention.
[Drawing 3] It is the decomposition perspective view of the light equipment concerning the 1st operation gestalt of this invention.
[Drawing 4] the attachment condition of the light equipment concerning the 1st operation gestalt of this invention is shown -- it is a cross-section perspective view a part.
[Drawing 5] It is the side elevation showing the light equipment concerning the 2nd operation gestalt of this invention.
[Drawing 6] It is the important section decomposition perspective view of the light equipment concerning the 3rd operation gestalt of this invention.
[Drawing 7] It is an explanatory view in the maximum length of notching concerning the 3rd operation gestalt of this invention.
[Drawing 8] It is the perspective view showing other examples of the crevice concerning the operation gestalt of this invention.
[Drawing 9] It is the outline perspective view showing the optical scanner concerning the conventional example.
[Drawing 10] It is the sectional view showing the attachment condition of the light equipment of the optical scanner concerning the conventional example.
[Description of Notations]
10, 70, 80 Optical scanner
12 Optical Box
42 Semiconductor Laser
44 82 Semiconductor laser drive circuit board
46 Attachment Component
54 Stretching Screw (Variation Rate Means)
58 Fixed Screw (Variation Rate Means)
60 Pore (Variation Rate Means)
62 Outgoing Radiation Aperture
66 Signal-Line Aperture
86 Notching

[Translation done.]